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RECORD OF DECISION

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

OLIN CORP. (McINTOSH PLANT) SITE

OPERABLE UNIT ONE

McINTOSH, McINTOSH COUNTY, ALABAMA

PREPARED BY

U. S. ENVIRONMENTAL PROTECTION AGENCY

REGION IV

ATLANTA, GEORGIA

DECLARATION
of the
RECORD OF DECISION
OPERABLE UNIT ONE

SITE NAME AND LOCATION

Olin Corp. McIntosh Plant Site
McIntosh, Mobile County, Alabama

STATEMENT OF BASIS AND PURPOSE

This decision document, presents the selected remedial action for Operable Unit One of the Olin Corp. (McIntosh Plant) Site, McIntosh, Alabama, ("the Olin Site" or "the Site") developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 ("CERCLA"), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA") 42 U.S.C. Section 9601 et seq., and to the extent practicable, the National Contingency Plan ("NCP") 40 CFR Part 300. This decision is based on the administrative record for the Olin Site.

The State of Alabama, as represented by the Alabama Department of Environmental Management ("ADEM"), has been the support agency during the Remedial Investigation and Feasibility Study process for the Olin Site. In accordance with 40 CFR 300.430, as the support agency, ADEM has provided input during this process. ADEM has concurred with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Olin Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF SELECTED REMEDY

This operable unit is the first of two that are planned for the Site. This alternative calls for the design and implementation of response measures which will protect human health and the environment. The first operable unit addresses the source of the contamination on the Site as well as the groundwater contamination across the entire Site. While this remedy does address the principal threats at the Site, the second operable unit will involve continued study and remediation, if appropriate, of a drainage basin on the Site located adjacent to the Tombigbee River.

The major components of the selected remedy for operable unit one include:

- Extraction of the groundwater from horizontal and vertical wells with subsequent onsite treatment. The extraction wells would be designed to improve the RCRA Corrective Action Program and to capture,for treatment, the area of contamination including the area of dense brine accumulation;

- Upgrading and extending the existing cap over the old plant (CPC) landfill with a multimedia cap and performing additional groundwater monitoring in the vicinity of the landfill. The CPC landfill cap will be extended to encompass the former drainage ditch area. The clay cap that exists over the former CPC plant will be extended to the west, capping the contaminated soils;

- Quarterly monitoring and maintenance of the existing clay caps over the sanitary landfills, the lime ponds, and the strong brine pond, the asphalt cover over the mercury cell plant, and the fencing around the well sand residue area will be established. The findings of the inspections will be documented. If an inspection noted problem areas such as erosional areas, cracks in the asphalt, or insufficient cap depth, maintenance or corrective measures will be required. Maintenance and corrective measures will also be documented;

- Additional groundwater monitoring in the vicinity of the sanitary landfills will be implemented. In the event that monitoring indicates releases from the sanitary landfills, additional corrective action measures will be required;

- Monitoring to determine the effectiveness of the groundwater treatment in reducing the contaminant migration; and

- Institutional controls for land use and groundwater use restrictions.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate, and is cost-effective. Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years from commencement of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

Richard D. Green

RICHARD D. GREEN, ASSOCIATE DIRECTOR OF SUPERFUND AND EMERGENCY RESPONSE

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DATE

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Olin Chemicals Site
McIntosh, Alabama

1.0 SITE LOCATION AND DESCRIPTION

The Olin Corp. (McIntosh Plant) Site (hereinafter, "the Site") is located approximately 1 mile east-southeast of the town of McIntosh, in Washington County, Alabama. For an area location map and general Site map, see Figures 1 and 2, respectively. The property is bounded on the east by the Tombigbee River, on the west by land not owned by Olin west of U. S. Highway 43, on the north by the Ciba-Geigy Corporation plant site and on the south by River Road. The Olin McIntosh plant is an active chemical production facility. The main plant and associated Olin properties cover approximately 1,500 acres, with active plant production areas occupying approximately 60 acres.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Olin Corporation ("Olin") operated a mercury cell chlor-alkali plant (constructed in 1951) on a portion of the Site from 1952 through December 1982. In 1952, Alabama Chemical Company began operation of a chlorinated organics plant on property immediately south of the Olin plant. In 1954, Olin acquired Alabama Chemical and in 1955 began construction of a pentachloronitrobenzene ("PCNB") plant on the acquired property. The plant was completed and PCNB production was started in 1956. The McIntosh plant was expanded in 1973 to produce trichloroacetonitrile ("TCAN") and 5-ethoxy-3trichloromethyl-1,2,4-thiadiazole ("Terrazole®"). The PCNB, TCAN and Terrazole® manufacturing areas were collectively referred to as the Crop Protection Chemicals ("CPC") plant. In 1978, Olin began operation of a diaphragm cell caustic soda/chlorine plant, which is still in operation. Olin shut down the CPC and mercury cell chlor-alkali plants between 1982 and 1986. The CPC plant was decommissioned and dismantled and the site was capped.

The McIntosh plant today produces chlorine, caustic soda, sodium hypochlorite and sodium chloride and blends and stores hydrazine compounds. Current active facilities at the plant include: a diaphragm cell chlorine and caustic production process area; a caustic concentration process area; a caustic plant salt process area; a hydrazine blending process area; shipping and transport facilities; process water storage, transport and treatment facilities; and support and office areas. Olin mines a salt dome through a series of brine production wells located to the west of the active plant facility. The salt dome cap is at a depth of approximately 500 feet below the surface. The dome is approximately 4,500 feet in diameter

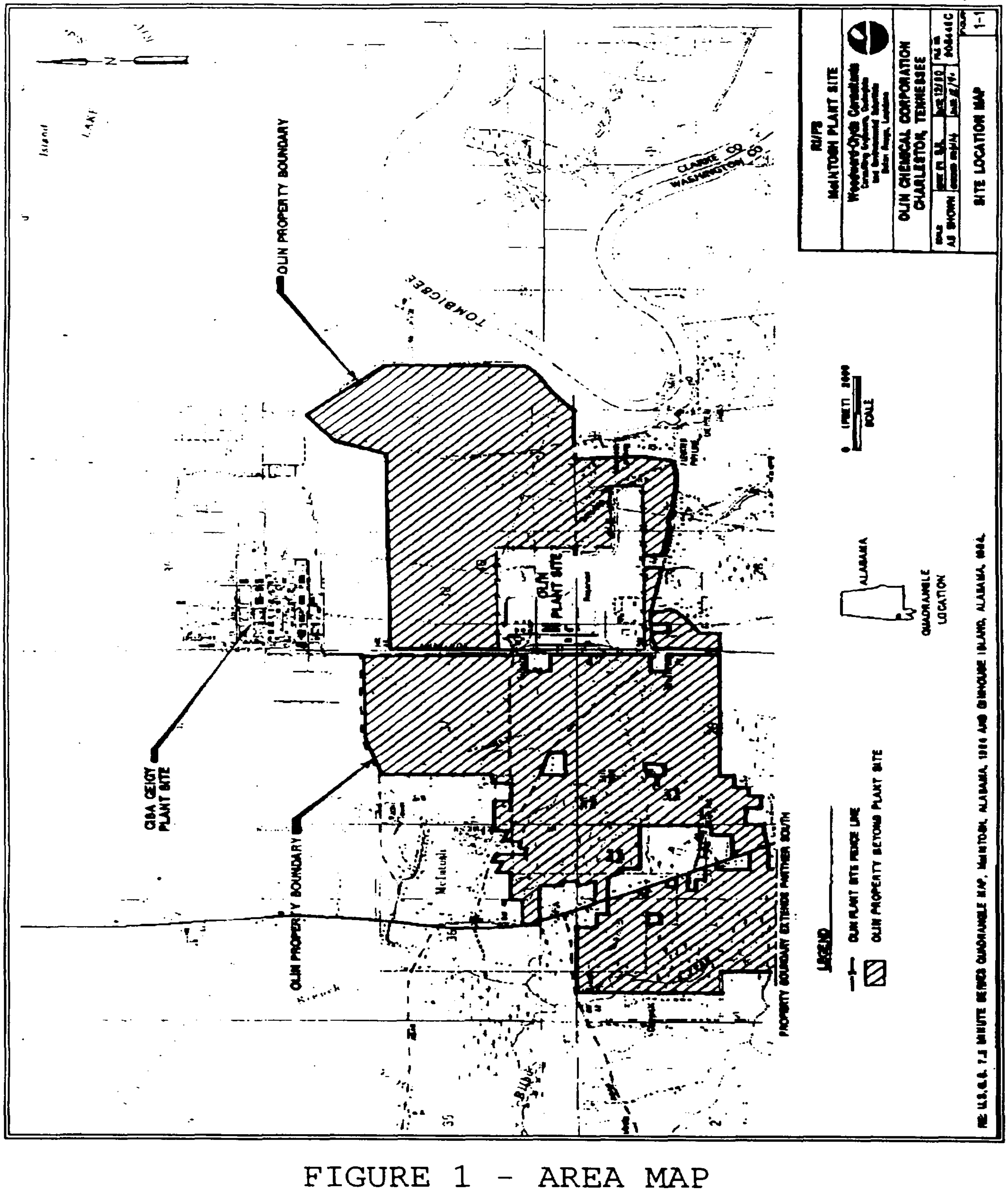


FIGURE 1 - AREA MAP

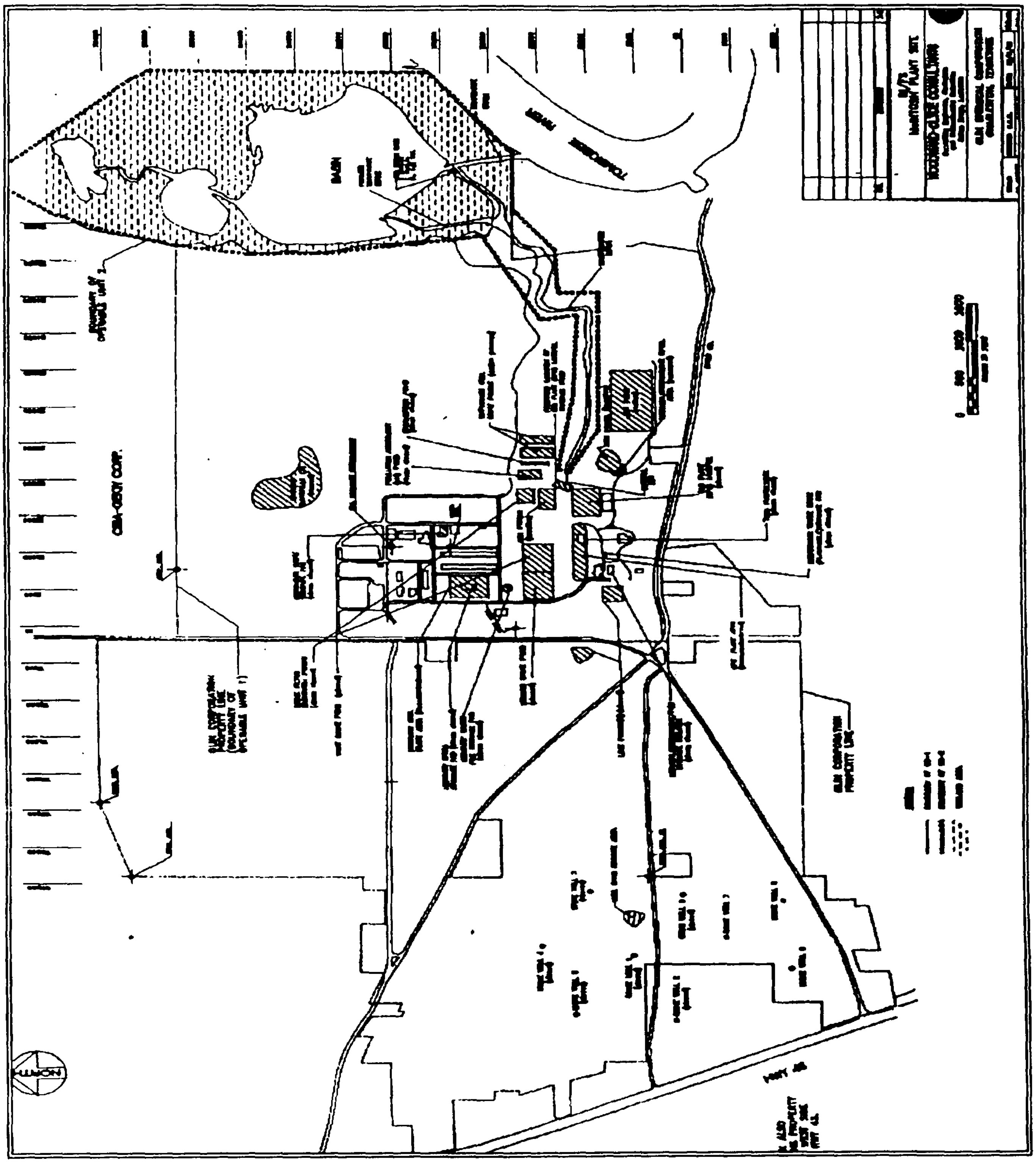


FIGURE 2 - SITE MAP

and greater than 2 miles deep. Nine brine wells have been completed in the salt dome for the production of brine. The first six wells were associated with the mercury cell chlor-alkali plant and are no longer in service. The other three brine production wells were developed in a different portion of the salt dome, have been used exclusively for the diaphragm cell plant, and are still in use. A tenth cavity was developed in the dome by Olin for use by the Alabama Electric Cooperative to store high-pressure (1200 psi) air for off-peak power production.

The Olin McIntosh plant currently monitors and reports on numerous facilities within the plant that are permitted through the EPA and the Alabama Department of Environmental Management (ADEM). These include water and air permits as well as a Resource Conservation and Recovery Act (RCRA) post-closure permit. The RCRA post-closure permit requires groundwater monitoring for closed RCRA units, including the weak brine pond, the stormwater pond and the brine filter backwash pond. The post-closure permit also requires corrective action for releases of 40 CFR 261 Appendix VIII constituents from any solid waste management units (SWMUs) at the facility. There are no active RCRA units at the facility. Olin also has permits for three injection wells for mining salt and a neutralization/percolation field.

Investigations have indicated contamination in a 65-acre natural basin, located on the Olin property east of the active plant facilities. The plant wastewater ditch currently carries the NPDES discharge and storm water runoff from the manufacturing areas, as well as from some of the west, east and southeast manufacturing areas of Olin property to the Tombigbee River. From 1952 to 1974, plant wastewater discharge was routed through the basin and then to the Tombigbee River. In 1974, a discharge ditch was constructed to reroute the wastewater directly to the Tombigbee River.

In September 1984, Olin's McIntosh plant site was placed on the National Priority List of CERCLA or "Superfund " Groundwater contamination at the site had been established based on the results of various investigations. Mercury and chloroform were the principal contaminants identified at the site. Mercury contamination was evidently caused by the operation of the mercury cell chlor-alkali plant during the period 1952 to 1982. The chloroform contamination is probably a degradation product from the operation of the TCAN plant from 1973 to 1982.

In 1989, EPA and Olin entered into an Administrative Order on Consent ("AOC") for Olin to conduct a remedial investigation/feasibility study ("RI/FS") under EPA oversight.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

On December 12 1990, at the beginning of Remedial Investigation field work, an availability session at a local library and interviews with local officials and community were held. The main branch of the

Mobile Public Library at 300 Pine Street was chosen as the local information repository for the Site. On March 12, 1992, Olin held a public meeting to discuss an upcoming removal action at the Site. In addition, a fact sheet concerning the RI was sent to those on the mailing list in May 1992.

A Proposed Plan fact sheet and Administrative Record containing the final RI and Feasibility Study ("FS") was issued to the public on February 28, 1994 to the repository. The public comment period on the Proposed Plan was held from March 1, 1994 through March 30, 1994. A public meeting was held on March 15, 1994 where EPA answered questions regarding the Site and the Proposed
plan under consideration. The administrative record was available to the public at both the information repository maintained at the Mobile Public Library and at the EPA Region IV Library at 345 Courtland Street in Atlanta, Georgia. The notice of availability of these documents was published in the Mobile News-Herald on February 28, 1994. Responses to the significant comments received during the public comment period and at the public meeting are included in the Responsiveness Summary, which is part of this ROD in Appendix A.

This decision document presents the selected remedial action for operable unit one of the Olin Site, chosen in accordance with CERCLA, as amended by SARA, and the NCP. The decision for this Site is based on the administrative record. The requirements under Section 117 of CERCLA/SARA for public and state participation have been met for this operable unit.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

As with many Superfund sites, the problems at the Olin Site are complex. As a result, EPA has organized the work at this Site into the following two phases or operable units ("OUs"):

- OU-1: OU-1 consists of the active production facility, Solid Waste Management Units ("SWMUs"), and the upland area of Olin property. The areas in OU-1 beyond the active production facilities include predominantly undeveloped areas to the north and northwest and the brine well field to the west. The most distinctive topographic feature is a steep bluff located approximately 4,000 feet east of the main plant area. This bluff defines the edge of the low-lying OU-2 floodplain area.

- OU-2: OU-2 consists of a basin, floodplain, and a wastewater ditch leading to the basin. The basin is a natural oxbow lake lying within the floodplain of the adjacent Tombigbee River. During the seasonal high water levels (approximately 4 to 6 months per year), the basin is inundated by surface water, and thus becomes contiguous with, the adjacent river. A remedy for OU-2 will be developed in a subsequent ROD, if it is determined that remedial action will be necessary.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 GENERAL SITE CHARACTERISTICS

The McIntosh area is underlain by alternating beds of unconsolidated-to-consolidated sedimentary rocks that are collectively hundreds of feet thick. The McIntosh salt dome is the most distinctive structural feature of the area.

The groundwater in the vicinity of the Olin Site contains two major aquifers, the Alluvial and the Miocene: The Alluvial Aquifer in the main plant area varies in thickness from an average of about 55 feet to 80 feet. The Alluvial Aquifer is generally unconfined throughout the area. The hydraulic conductivity was estimated to be between 4 ft/day and 40 ft/day. Groundwater in the Alluvial Aquifer generally enters the site from the north. The southerly flow is divided into southeast and southwest components by a groundwater divide oriented north-south through the center of the plant site. Flow to the east of this divide is to the east and southeast, discharging to the basin in the northern portion of the Site and farther south, flow continues in a southeasterly direction toward RCRA corrective action wells.

In off-site areas southeast of the facility, groundwater from the Alluvial Aquifer discharges to the Tombigbee River. On the western side of the groundwater divide, flow is south and southwest toward the groundwater recovery area created by RCRA corrective action wells. A hydraulic mound farther to the west deflects westerly flow to the south in the brine field area. The groundwater flow patterns are affected by the seasonal rises in the Tombigbee River. During periods of high river stage, instead of groundwater discharging eastward, the basin and Tombigbee River become recharge areas and groundwater flow is to the west toward the active facility.

The Miocene units are designated as Tm1, and Tm2. The Miocene confining unit (Tm1) consist of clays, sandy clays, or clayey sands. Boring logs from wells that penetrate the upper Miocene confining unit indicate that this unit is approximately 80 to 100 feet thick. The Miocene Aquifer (Tm2) is composed primarily of thick-bedded coarse sand and gravel beds. The upper Miocene Aquifer (Tm2) contains two main artesian sands that are separated by a clayey unit ranging from 10 to 20 feet thick. The sands are considered as one hydrogeologic unit due to a natural hydraulic connection and connection by gravel--packed wells. The combined transmissivity of the two sands is considered to be in excess of about 25,000 square feet per day. The regional gradient of the Miocene Aquifer is to the east-southeast, however, Olin continuously pumps two Miocene Aquifer process water wells. The effect of pumping process water wells is to cause groundwater flow in the Miocene Aquifer to be toward the process water wells across the plant area.

The active production areas of the plant are relatively flat. A topographic high of greater than 50 feet (above mean sea level) extends from the northern to the southern extent of Olin's property, west of the production facility and east of the brine well field. This topographic high creates a drainage divide that defines the two major surface water drainage pathways. A steep bluff located approximately 4,000 feet east of the main plant area defines the edge of the low-lying floodplain area, which is about 25 feet lower in elevation than the upland areas immediately to the west. Runoff from the northern portions of the site east of the drainage divide flows eastward to a low-lying area between the plant area and the basin. There is also a small east-west drainage divide in the northeast corner of the Olin property. Flow to the north of this divide is to the Ciba-Geigy property.

The watershed for the basin within the floodplain area is limited to the area defined as OU-2. The basin and surrounding wetlands lie within the floodplain of the Tombigbee River. The most significant feature of OU-2 is the basin.

5.2 Summary of Site Contamination

5.2 1 Source Evaluation

A source evaluation was conducted which included a review of the RCRA quarterly groundwater data to evaluate trends in chemical concentrations that may indicate the presence of significant sources of groundwater contamination. Potential sources were also evaluated using the results of the RI soil sampling.

5.2.2 SWMU SOILS EVALUATION

Potential source areas were evaluated by examining trends in quarterly groundwater data from 1987 until 1991 and conducting subsurface soil sampling at SWMUs. Subsurface soil samples were collected from the following SWMUs/AOCs:

- Old plant (CPC) landfill
- Former CPC plant area
- Sanitary landfills
- Lime ponds
- Strong brine pond
- Former mercury-cell plant
- Old plant (CPC) landfill drainage ditch
- Well sand residue area

The sampling results are summarized in the following sections.

5.2.2.1 Old Plant (CPC) Landfill

The site of the old plant (CPC) landfill was utilized from 1954 until

1972 to neutralize acidic wastewater from CPC plant operations. The landfill area is approximately 300 x 400 feet and is estimated to have had an 8,000-cubic-yard capacity. During the RI sampling soil and residual waste samples were analyzed for the EPA's Contract Laboratory Program (CLP) Target Compound List (TCL) volatile organics, TCL semivolatile organics, TCL pesticides/PCBs and the selected Target Analyte List (TAL) constituents.

The vertical distribution of constituents in three of the soil borings (BOP2, BOP3 and BOP4) showed decreases in constituent concentrations with increasing depth. At BOP2 and BOP3, the constituent concentrations in the clay beneath the landfill and in the underlying sand above the water table are near or below detection limits. Concentrations of organic constituents at BOP4, located in the western portion of the landfill, indicate migration of constituents through the clay and into the upper portion of the unsaturated underlying sand. The data for BOP1, located in the western portion of the landfill, indicate that organic constituents have migrated through the clay and the unsaturated portion of the underlying sand. Overall, the data indicate that migration of organic constituents into the Alluvial Aquifer from the soil is most likely in the western portion of the landfill. Based on the analytical results described above, the old plant (CPC) landfill was identified as a potential source of contaminants, particularly organics, to the groundwater.

5.2.2.2 Former CPC Plant

The former CPC plant was constructed in 1952 and initially manufactured monochlorobenzene, adding pentachloronitrobenzene (PCNB) in 1956. In 1973, the plant was expanded to produce trichloro-acetonitrile (TCAN) and 5-ethoxy-3-trichloromethyl-1,2,4-thiadiazole (Terrazole®). The PCNB, TCAN and Terrazole® manufacturing areas were collectively referred to as the crop protection chemicals (CPC) plant. The CPC plant was shut down in 1982. In 1984 the plant area was dismantled and covered with an approximately 2-foot-thick recompacted clay cap and topsoil. The capped area was then vegetated.

During the RI, borings were drilled into the unsaturated sand above the Alluvial Aquifer. The soil samples were analyzed for CLP TCL volatile organics, TCL semivolatile organics, TCL pesticides/PCBs, and the selected list of TAL constituents.

Chemicals of concern were detected in soil samples from boring (BCP1) at the west boundary of the old plant area. The data from the area west of the former CPC plant (BCP1) showed chlorobenzene at a maximum concentration of 0.54 mg/kg in the upper clay material. Benzene, carbon disulfide and chloroform were also detected in the clay, at concentrations less than 0.02 mg/kg. The detected TCL semivolatile chlorinated benzenes in the two clay samples ranged from an estimated concentration of 0.2 mg/kg for hexachlorobenzene to 750 mg/kg for 1,2,4,5-tetrachlorobenzene. Concentrations in BCP1 decreased with depth in the sand. Two TCL chlorinated benzenes were detected in the bottom (sand) sample from BCP1 (30 to 32 feet): hexachlorobenzene at 1.5 mg/kg and 1,2,4,5-tetrachlorobenzene at an estimated concentration below the quantitation limit (CRQL) of 0.055 mg/kg. The data indicated a potential for the area west of the former CPC plant to be a continuing source of groundwater contamination, therefore soil action levels were developed.

5.2.2.3 Sanitary Landfills

There are two sanitary landfills which comprise about 12 acres. Cells at the landfills are 6 feet deep. The landfills were intended for the disposal of only sanitary waste, trash, and debris, however, sampling was conducted to address a report which suggested that the landfills received wastes containing hexachlorobenzene and mercury sludges. Each boring penetrated the full waste depth (0 to 7 feet) and was composited for analysis. The samples were analyzed for CLP TCL volatile organics, TCL semivolatile organics TCL pesticides/PCBs, and the selected list of TAL constituents. The samples were also analyzed using the toxic characteristics leaching procedure (TCLP) for mercury.

Hexachlorobenzene concentrations ranged from 9.5 mg/kg to 44 mg/kg. Mercury concentrations ranged from 7.8 to 27.1 mg/kg. The chlorinated benzenes: chlorobenzene, 1,2,4,5-tetrachlorobenzene, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, and 1,3-dichlorobenzene were detected at low concentrations (<10 mg/kg). Pentachlorobenzene and pentachloronitrobenzene were tentatively identified in the sanitary landfill samples at estimated concentrations ranging from 1.0 mg/kg to 3.6 mg/kg for pentachlorobenzene and 0.16 mg/kg to 31 mg/kg for pentachloro-nitrobenzene. 2,3,4,5,6-pentachlorobenzamine was tentatively identified with estimated concentrations ranging from 0.25 mg/kg to 6.5 mg/kg. The data were evaluated to determine whether contaminants present in the landfills would affect the groundwater above MCLs.

Fate and transport analysis of the data indicated that constituents percolating in infiltrating water through the soils in the sanitary landfill would be unlikely to affect the Alluvial Aquifer above the MCL at the landfill boundary.

5.2.2.4 Lime Ponds

The east and west lime ponds were used to manage spent lime slurry used to absorb chlorine gas from various vent streams. Their use ceased in 1976 and they were closed in 1979 with ash for stabilization, a clay cap, topsoil and grass. The lime ponds are located 10 to 15 feet above natural grade. The lime waste in these ponds is covered by 0.5 to 6.0 feet of clay/sandy clay and about 10 feet of ash. Samples were analyzed fc total and TCLP mercury.

The sample results are summarized below:

Boring	Sample Interval (ft)	TAL Mercury Result (mg/kg)	TCLP Mercury Result (µg/l)
BL1	16 to 18	1.3	10
BL2	12 to 14	0.46	3

The Summers model was used to assess the concentration of mercury in the groundwater of the Alluvial Aquifer that could result from infiltration of leachate from the closed lime ponds. The assumption that the infiltrating water for each lime pond has a mercury concentration equal to that of the highest mercury TCLP result (10 µg/l) was used in the calculation. The analysis indicated that mercury from the former lime ponds would be unlikely to affect the Alluvial Aquifer above the MCL at the lime pond boundaries.

5.2.2.5 Strong Brine Pond

The strong brine pond was a holding pond for the strong brine process fluid that was removed from the brine wells for use in the mercury cell plant. It was removed in 1985. It was approximately 340 x 340 feet and constructed partially above-grade in natural clay.

The pond was sampled to assess whether mercury-containing brine seeped from the pond and contaminated the underlying soils to the extent that mercury can be leached to the groundwater. Mercury concentrations from the TCLP leachate were 5 µg/l and 30 µg/l for the two samples. These results indicate that some mercury has migrated to the natural soils beneath the former pond. An analysis was performed to evaluate whether the leachate from the subsoil could affect the Alluvial Aquifer. The Summers model calculation was completed to assess what concentration of mercury in the groundwater of the Alluvial Aquifer could result from infiltration of water through the subsoil. The assumption that the infiltrating water has a mercury concentration equal to that of the highest mercury TCLP result (30 µg/l) was used in the calculation. The analysis indicated that mercury in water percolating through the soil beneath the closed strong brine pond would be unlikely to affect the Alluvial Aquifer above the MCL at the SWMU boundary.

5.2.2.6 Former Mercury Cell Plant

The former mercury cell plant area was the location of the mercury cell rooms until the plant was shutdown in 1982 and demolished in 1986. Decommissioning included removing all above ground structures to the concrete bottom floor of the building. The sumps and trenches were filled with clay. The floor was covered with a synthetic roofing membrane (Durbigum®) and asphalt. The area (approximately one acre) was sampled in an unbiased grid pattern. The results are summarized below:

Boring	Sample Interval (ft)	TAL Mercury (mg/kg)	TCLP Mercury (µg/l)
BMC1	0 to 4	<0.12	<2
BMC2	0 to 4	<0.12	<2
BMC3	0 to 4	<0.12	<2
BMC4	0 to 4	164	40
BMC5	0 to 4	0.38	<2
		0.16 (Duplicate)	
BMC6	0 to 4	3.4	<2

A Summers model analysis was used to evaluate the potential migration from the mercury cell plant. The assumption that the infiltrating water would have a concentration of 40 µg/l was used in the analysis. The analyses of the soil samples from beneath the former plant indicates that if leachate infiltrated into the Alluvial Aquifer, mercury concentrations in otherwise uncontaminated groundwater would be unlikely to exceed the MCL of 2 µg/l at the mercury cell plant boundary.

5.2.2.7 Old Plant Landfill Drainage Ditch

The old plant landfill drainage ditch formerly drained from the old plant (CPC) landfill to the wastewater ditch. Due to extensive earth work in the area associated with the closure of the old plant (CPC) landfill, there is no longer any surface remnant of the ditch. Samples were analyzed for CLP TCL volatile organics, TCL semivolatile organics, TCL pesticides/PCBs, and the selected list of TAL constituents. Mercury, at a concentration of 10 mg/kg, and hexachlorobenzene, at a concentration of 6 mg/kg, are the contaminants which were found in any significant concentration. The old plant landfill drainage ditch soils are not in a defined area, therefore, quantifiable fate and transport analysis to assess potential impact on groundwater was not performed. However, due to the close proximity of the drainage ditch to the old plant (CPC) landfill, the ditch soils are included with the landfill soils. A quantitative evaluation of the potential for migration to groundwater was performed for the old plant (CPC) landfill and potential soil action levels were developed.

5.2.2.8 Well Sand Residue Area

Well sands were generated from development and operation of the brine wells for the mercury cell chlor-alkali process. These sands are residues of the material from the salt domes. During early operation of the mercury cell plant, when the well sands were generated, they were deposited in mounds in an area referred to as the well sand residue area. The well sand in these mounds is a cohesive granular material that has the consistency of sandstone. Samples were collected at ten randomly selected areas and depths within the mounds. The 10 individual samples were ground and composited into one sample for analysis (mercury and TCLP mercury). The total mercury concentration detected in the well sand composite sample was 20.1 mg/kg. Mercury was not detected in the leachate from the TCLP analysis. Therefore, the well sand is not considered a current source of groundwater contamination.

5.2.3 Groundwater Evaluation

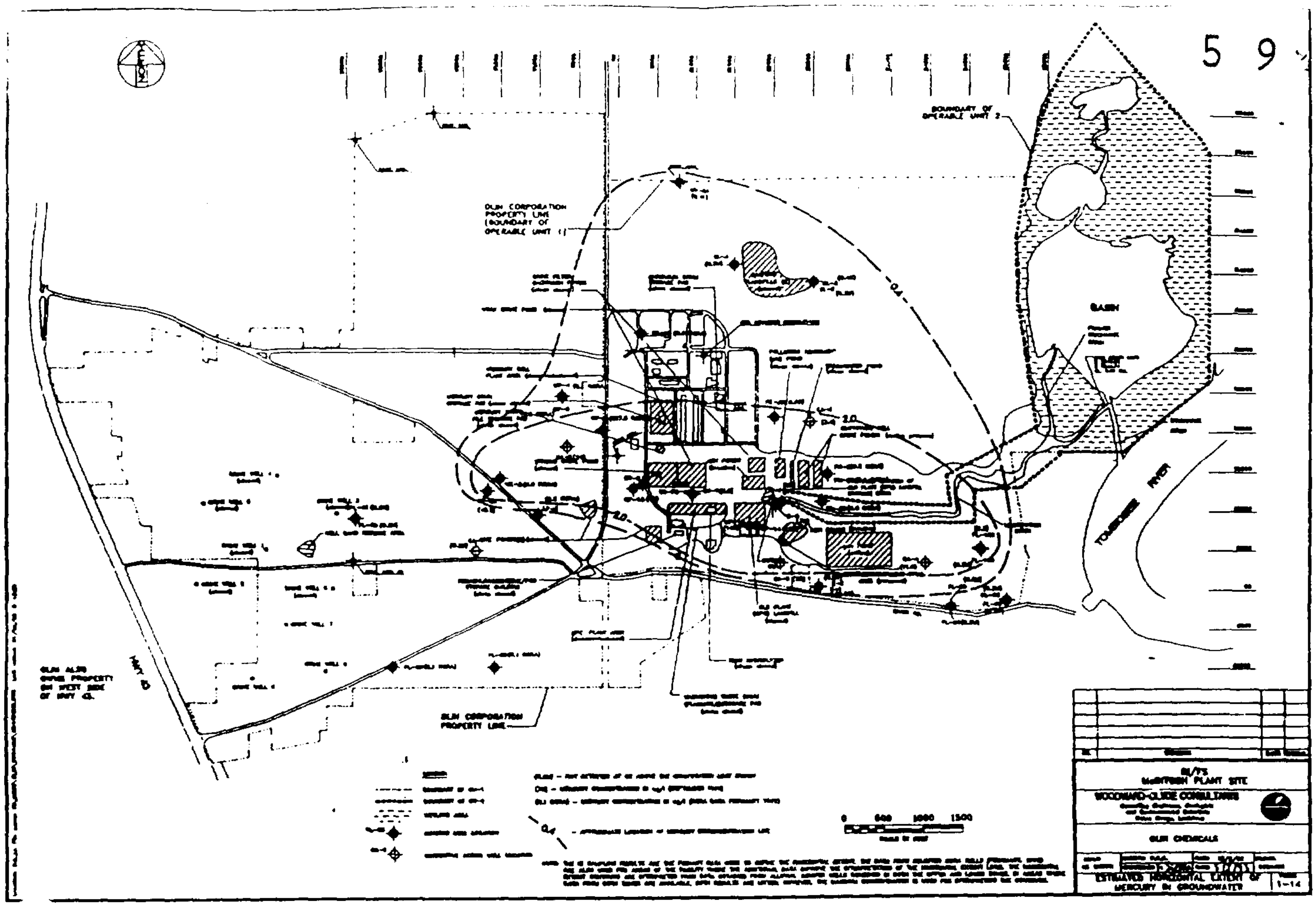
There are two aquifers of concern at the Olin McIntosh site: the Alluvial Aquifer and the Miocene Aquifer. Based on investigations of Alluvial Aquifer Olin implemented a groundwater corrective action program in 1987. The ongoing RCRA monitoring includes quarterly sampling of compliance and corrective action wells screened in the Alluvial Aquifer. The groundwater flow direction over the horizontal extent of OU-1 is towards the corrective action wells.

5.2.3.1 Alluvial Aquifer Sampling Results

Twenty-nine monitoring wells and corrective action wells screened in the Alluvial Aquifer were sampled at the facility from September 9, 1991 through September 19, 1991. The wells were sampled for the following constituents: mercury (total and dissolved), a selected list of 13 additional Target Analyte List (TAL) compounds (total and dissolved); Target Compound List (TCL) volatile organics; TCL semivolatile organics; TCL pesticides/PCBs and chloride. Both mercury and chloroform were reported at concentrations higher than the Primary Drinking Water Standard MCLs.

Mercury is the primary inorganic constituent of concern at the facility and was selected to define the extent of inorganics. Chloroform was used to define the extent of organics because of its prevalence in all perimeter wells containing organics and generally at concentrations higher than other organics. The exception is at the west perimeter, where chlorobenzene was reported at a greater concentration than chloroform. Therefore, with the exception of the west perimeter, chloroform was used to define the horizontal extent of organics.

The horizontal extent of mercury and chloroform in the groundwater is presented in following figures: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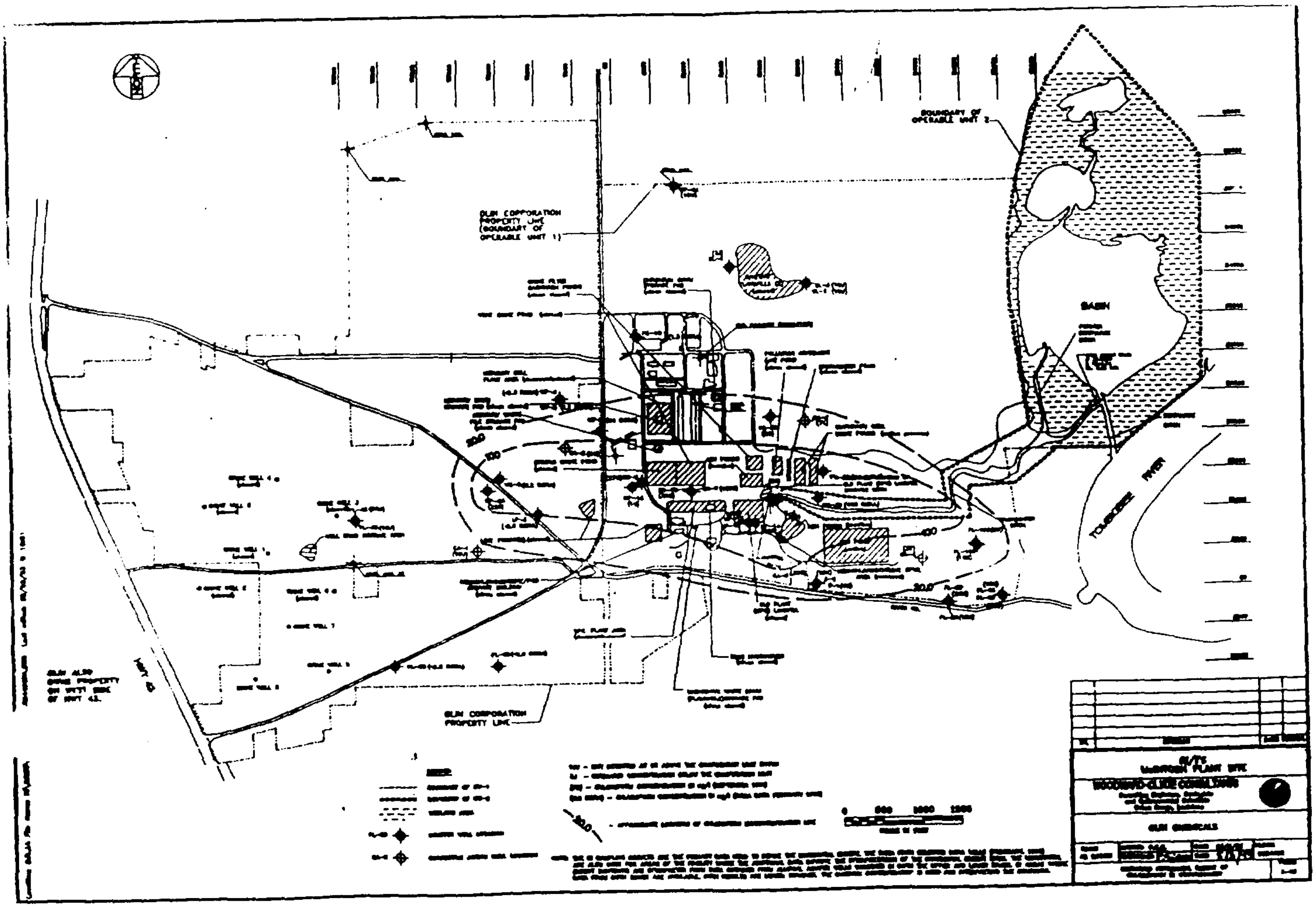
OLIN CORPORATION PROPERTY LINE (BOUNDARY OF OPERABLE UNIT 1)
BASIN
TOMBIGBEE RIVER
OLIN CORPORATION PROPERTY LINE
OLIN CHEMICALS
ESTIMATED HORIZONTAL EXTENT OF MERCURY IN GROUNDWATER
0 500 1000 1500


BOUNDARY OF OPERABLE UNIT 2
OLIN CORPORATION PROPERTY LINE (BOUNDARY OF OPERABLE UNIT 1)
BASIN
TOMBIGBEE RIVER
OLIN CORPORATION PROPERTY LINE
0 500 1000 1500

5.2.3.2 **Miocene Aquifer Sampling Results**

Two process water wells and two monitoring wells screened in the Miocene Aquifer were also sampled as part of the RI. Chlorobenzene, 1,2-dichlorobenzene, and 1,4-dichlorobenzene were reported in the groundwater samples from one of the process water wells screened in the Miocene Aquifer. However, the detected concentrations in this well were less than the MCLs.

McIntosh City Water Wells 1 and 2, are also screened in the Miocene Aquifer. Water Well 1 is about 2 miles to the northwest and Water Well 2 is about 5 miles southwest of the site. The data indicate that Wells 1 and 2 have not been affected by contamination from the site.

5.2.3.3 **Residential Well Sampling Results**

A total of 122 residential wells (active, inactive and closed) were identified within a 3-mile radius of the Olin facility; 34 of these wells which were identified as drinking water wells were sampled.

Samples from the drinking water wells identified in the domestic well survey were analyzed for the following constituents: total mercury, total organic carbon (TOC), total suspended solids (TSS), and chloride. In addition, the wells were analyzed for TCL volatile organic constituents. Mercury was reported in 1 of the drinking water wells and volatile constituents, which are related to the Olin facility were reported in some of the drinking water wells. All reported concentrations were below the respective MCLs.

5.2.4 **Surface Water Runoff**

The two major surface water drainage pathways within the Olin property were examined. The Olin plant discharges are routed either through the existing NPDES system or through areas sampled for Olin's storm water discharge permit. The NPDES permit limits are based on the Alabama water quality standards for the receiving water, which is the Tombigbee River. Olin continues to meet their NPDES limits as documented by their ongoing surface water monitoring programs.

6.0 SUMMARY OF SITE RISKS

The baseline risk assessment ("BRA") provides the basis for taking action and indicates contaminants and the exposure pathways that need to be addressed by the remedial action. It serves as an indication of what risks the site poses if no action were taken. This section of the ROD contains a summary of the results of the baseline risk assessment conducted for this site.

In the BRA, EPA evaluated Site risks for several environmental media. This ROD summarizes only human health exposures because OU1 is the plant facility and no significant ecological or habitats exposures are expected. Ecological risks will be evaluated for OU2 (the basin) in a subsequent ROD.

The risk assessment included the following major components: chemicals of concern, exposure assessment, toxicity assessment, and risk characterization.

6.1 Chemicals of Concern

The risk assessment evaluated current and potential future risks from exposure to chemicals of potential concern. The chemicals which are included in this Section as chemicals of concern are those for which the results of the risk assessment indicate that the contaminant might pose a significant current or future risk. Chemicals of concern are those compounds that contribute to a pathway that exceeds a 1×10^{-4} risk or a Hazard Index ("HI") of 1. Chemicals contributing risk to these pathways were not included if their individual carcinogenic risk contribution was less than 1×10^{-6} or their noncarcinogenic hazard Quotient ("HQ") was less than 0.1. In addition, chemicals were included if they exceeded either State or Federal ARARs.

The exposure point concentration for each contaminant was derived using the 95 percent upper confidence limit ("UCL") on the arithemetic mean. If the 95% UCL resulted in a concentration higher than the maximum concentration detected, the maximum concentration detected was used as the exposure point concentration. In order to provide an accurate assessment of risk from the Site.

Under the current land-use scenario, chemicals of concern would pose unacceptable risks if the on-site groundwater were used as a source of potable water. Future land use is likely to remain industrial on the property currently occupied by the site. Following is a list of those chemicals for which the results of the risk assessment indicates that the contaminant may pose a significant current or future risk. Also included are their cooresponding groundwater exposure point concentrations.

CHEMICALS OF CONCERN

Pathway/Chemical	Exposure Point Concentration (mg/l)[1]
Groundwater Ingestion	
1,2-dichlorobenzene	1.400
1,4-dichlorobenzene	2.076
1,2,4-trichlorobenzene	0.024
Alpha-BHC	0.004
Arsenic	0.003
Benzene	0.049
Beryllium	0.081[2]
Bromodichloromethane	0.010
Cadmium	0.022
Carbon Tetrachloride	0.006
Chlorobenzene	0.613
Chloroform	0.521
Chromium VI	0.172
Copper	0.103
Cyanide	0.104
Lead	0.050
Mercury	0.146[2]
Nickel	0.899[2]
Pentachlorobenzene	0.007
Pentachloronitrobenzene	0.005

[1] Exposure point concentration is based on 95% UCL of log normal distribution unless otherwise noted.

[2] Maximum detected concentration is listed instead of 95% UCL exceeds maximum concentration.

6.2 EXPOSURE ASSESSMENT

In the exposure assessment, EPA considered ways in which people could come into contact with contaminants under both current and future conditions. All likely pathways of exposure were evaluated. The current use of the land in the vicinity of the site is industrial to the north and residential to the south. Future land use is likely to remain industrial on the property currently occupied by the plant.

The risk assessment evaluated the potential exposure to chemicals of potential concern to adults and children living near or trespassing on the contamination currently, and site industrial workers. Exposure pathways for offsite residential receptors include (1) residential exposure to water from domestic wells screened in the Alluvial Aquifer (ingestion, dermal contact [through skin] and inhalation [breathing] of volatile organic constituents) and (2) potential contact with soils in OU1 areas (particulate inhalation). Children might potentially be at greater risk due to behavior patterns or sensitivity to chemical constituents. Exposure pathways for site industrial workers include exposure to groundwater via dermal and inhalation during quarterly sampling of groundwater from monitor and corrective action wells. And exposure to OU1 surface soils (dermal, ingestion and particulate inhalation).

The exposure point concentrations are the chemical concentrations to which a receptor is exposed when contact is made with a specific environmental medium.

The data used to develop the exposure point concentrations are summarized below:

- Groundwater: Chemical analyses of on-site groundwater samples collected from the monitor wells, corrective action wells and process water wells for the groundwater chemicals of potential concern.

- Surface Soil: Chemical analyses of soil samples collected from beneath the asphalt cap in the mercury cell plant area for mercury and the surficial soil (0-1 foot) sample collected from the old plant landfill drainage ditch for hexachlorobenzene.

- Domestic well water (off-site): Chemical analyses from the 34 drinking water wells that were sampled during November 1991 for those analytes that were detected in one or more of the samples.

To address air exposure pathways to environmental media for which measured concentrations were not available, modeled concentrations of the various constituents were used to estimate exposure point concentrations.

Additionally, chemical-specific dermal exposures to domestic well water and groundwater were calculated for the risk assessment.

In order to calculate the daily chemical intake, a number of exposure parameters are first quantified. Exposure parameters which are typically quantified include the following:

- Exposure frequency (days/year)
- Exposure time (hrs/day)
- Exposure duration (years)
- Groundwater ingestion rate (l/day)
- Soil/sediment ingestion rates (mg/day)
- Body weight (kg)
- Body surface area (m^2)
- Lifespan (days)
- Fish ingestion rates (g/day)

The exposure parameters are included in the text of the baseline risk assessment on pages 6-27 to 6-36. The numerical values used in the exposure algorithm were developed using the Exposure Factors Handbook (U. S. EPA, 1989b) and OSWER Directive 9285.6-03 (Standard Default Exposure Factors; U. S. EPA, 1991c) and the Risk Assessment Guidance for Superfund (RAGS) Manual (U. S. EPA, 1989a).

Exposure to a chemical is described in terms of intake. The measure of exposure has been defined as a reasonable maximum exposure. The reasonable maximum exposure has been estimated using guidance provided in EPA's Risk Assessment Guidance for Superfund (RAGS) (U.S. EPA, 1989a). The reasonable maximum exposure is defined by selecting intake variable values so that the combination of all intake variables results in a maximum exposure that is reasonably expected to occur at the site.

6.3 TOXICITY ASSESSMENT

Slope factors (SFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals of concern. SFs, which are expressed in units of $(mg/kg/day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg/day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this conservative approach makes underestimation of the actual cancer risk highly unlikely. Slope factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

The SF is used to estimate an upper-bound probability of an individual developing cancer as a result of exposure to a potential carcinogen. Chemicals, both carcinogenic and noncarcinogenic, are given an EPA weight-of-evidence classification.

The following classifications were derived from, Environmental Protection Agency (U. S. EPA). 1989. Risk assessment guidance for Superfund. Volume I: Human Health evaluation manual. Interim final. Office of Emergency and Remedial Response. EPA. Washington, D. C. EPA/625-3-89/002.

Group	Classification
A	Human carcinogen. Sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer.
B1/B2	Probable human carcinogen; B1 indicates that limited human data are available from epidemiologic studies. B2 indicates sufficient evidence in animals and inadequate or no evidence in humans of carcinogenicity.
C	Possible human carcinogen. Limited evidence of carcinogenicity in animals.
D	Not classifiable as to human carcinogenicity. Inadequate evidence of carcinogenicity in animals.
E	No evidence of carcinogenicity in humans or in at least two adequate animal tests or in both epidemiologic and animal studies.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of chemicals of concern ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans).

The RfD and SF values used in the risk assessment were obtained from the following sources:

- EPA's Integrated Risk Information System (IRIS) (U. S. EPA, 1992b) on-line database system
- EPA's Health Effects Assessment Summary Tables (U. S. EPA, 1992d)

When toxicity values were found from both sources for a given constituent, priority was given to the IRIS value. Constituents of potential concern not possessing verified RfDs or SFs are addressed qualitatively in the risk characterization section of the Remedial Investigation Report (Section 6.7). The slope factors and weight-of-evidence classifications for the chemicals of potential concern are also included in the following table.

RfCs, RfDs, SLOPE FACTORS, AND CARCINOGEN CLASSIFICATION FOR CHEMICALS OF CONCERN

Chemical	Carcinogenic Status	Inhalation		Ingestion/Dermal	
		Slope Factor $(mg/kg/day)^{-1}$	Chronic RfC mg/kg/day	Slope Factor $(mg/kg/day)^{-1}$	Chronic RfD mg/kg/day
Alpha-BHC	B2	6.30E+00	ND	6.30E+00	ND
Arsenic(1)	A	5.0E+01	8.3E-05	1.75E+00	3.00E-04
Benzene(1)	A	2.90E-02	ND	2.90E-02	ND
Beryllium(1)	B2	8.40E+00	ND	4.30E+00	5.00E-03
Bromodichloromethane(1)	B2	ND	ND	1.30E-01	2.00E-02
Cadmium (soil)(1)	ND	ND	ND	ND	1.00E-03
Cadmium (water)(1)	B1	6.1-E+00	ND	ND	5.00E-04
Carbon Tetrachloride(1)	B2	5.3E-02	ND	1.3E-01	7.00E-04
Chlorobenzene(1)	C	ND	5.00E-03	ND	2.00E-02
Chloroform(1)	B2	8.1E-02	ND	6.1E-03	1.00E-02
Chromium VI(1)	D	4.1E+01	5.70E-07	ND	5.00E-03
Copper(3)	D	ND	ND	ND	3.70E-02
Cyanide(2)	ND	ND	ND	ND	2.00E-02
1,2-Dichlorobenzene(1)	D	ND	4.00E-02	ND	9.00E-02
1,4-Dichlorobenzene(2)	C	ND	2.00E-01	2.4E-02	ND
Lead(1)	B2	ND	ND	ND	7.00E-01
Mercury(1)	D	ND	8.6E-05	ND	3.00E-04
Nickel(1)	A	8.4E-01	ND	ND	2.00E-02
Pentachlorobenzene(1)	ND	ND	ND	ND	8.00E-04
Pentachloronitrobenzene(2)	C	ND	ND	2.60E-01	3.00E-03
1,2,4-Trichlorobenzene(1)	ND	ND	3.00E-03	ND	1.31E-03

NOTES: Delta-BHC, bromobenzene and 1,3-dichlorobenzene were not included in this table since these constituents lack published toxicity values.

ND = Not determined or available

(1) = Value presented by IRIS (EPA, 1992b)

(2) = Value presented by HEAST (EPA, 1992c)

(3) = Value calculated from Safe Drinking Water Act treatment technique.

6.4 RISK CHARACTERIZATION

Human health risks are characterized for potential carcinogenic and noncarcinogenic effects by combining exposure and toxicity information. For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a life-time as a result of exposure to the carcinogen. Excess life-time cancer risk is calculated from the following equation:

Risk = CDI x SF where: risk = a unit less probability (e.g.,2 x 10^{-5}) of an individual developing cancer

CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SF = slope factor, expressed as $(mg/kg\text{-}day)^{-1}$

These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$ or 1-E-6). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a reasonable maximum estimate, an individual has a one in one million additional (above their normal risk) chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site. EPA considers individual excess cancer risks in the range of $1x10^{-4}$ to $1x10^{-6}$ as protective; however the $1x10^{-6}$ risk level is generally used as the point of departure for setting cleanup levels at Superfund sites. The point of departure risk level of $1x10^{-6}$ expresses EPA's preference for remedial actions that result in risks at the more acceptable end of the risk range.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specific time period (e.g., life-time) with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that the toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemicals of concern that affect the same target organ (e.g., liver) within a medium or across all media to which a given population may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. The HQ is calculated as follows:

HQ = **CDI/RfD where: CDI = Chronic daily intake**
RfD = reference dose

CDI and RfD are expressed in the same units (mg/kg-day) and represent the same exposure period.

Quantified carcinogenic and noncarcinogenic risks for each chemical of concern in each relevant exposure medium for each exposure pathway are presented in the following table.

SUMMARY OF CHEMICAL-SPECIFIC RISKS USED TO DEVELOP REMEDIAL GOAL OPTIONS[1]

FUTURE ADULT OU-1 RESIDENT

	Excess Lifetime Cancer Risk	Chronic Hazard Index
Ingestion of OU-1 Groundwater		
Cumulative Risk for Pathway	5E-3	2E+1
1,2,4-trichlorobenzene	--	5E-1
1,2-dichlorobenzene	--	4E-1
1,4-dichlorobenzene	6E-4	--
Alpha BHC	3E-4	--
Arsenic	6E-5	3E-1
Benzene	2E-5	--
Beryllium	4E-3	4E-1
Bromodichloromethane	2E-5	--
Cadmium	--	1E+0
Carbon Tetrachloride	9E-6	2E-1
Chlorobenzene	--	8E-1
Chloroform	4E-5	1E+0
Chromium (VI)	--	9E-1
Cyanide	--	1E-1
Mercury	--	1E+1
Nickel	--	1E+0
Pentachlorobenzene	--	2E-1
Pentachloronitrobenzene	2E-5	--
Inhalation of OU-1 Groundwater Volatile Compounds		
Cumulative Risk for Pathway	--	3E+0
Chlorobenzene	--	2E-1
Mercury	--	2E+0
Dermal Contact with OU-1 Groundwater		
Cumulative Risk for Pathway	1E-4	--
1,4-dichlorobenzene	9E-5	--
Alpha-BHC	1E-6	--
Benzene	5E-6	--
Beryllium	2E-5	--
Chloroform	1E-5	--
Pentachloronitrobenzene	2E-6	--

SUMMARY OF CHEMICAL-SPECIFIC RISKS USED TO DEVELOP REMEDIAL GOAL OPTIONS

FUTURE CHILD OU-1 RESIDENT

	Excess Lifetime Cancer Risk	Chronic Hazard Index
Ingestion of OU-1 Surface Soil		
Cumulative Risk for Pathway	--	7E+0
Mercury	--	7E+0
Ingestion of OU-1 Groundwater		
Cumulative Risk for Pathway	2E-3	5E+1
1,2,4-trichlorobenzene	--	1E+0
1,2-dichlorobenzene	--	1E+0
1,4-dichlorobenzene	3E-4	2E-1
Alpha BHC	1E-4	--
Arsenic	3E-5	6E-1
Benzene	8E-6	--
Beryllium	2E-3	1E+0
Bromodichloromethane	7E-6	--
Cadmium	--	3E+0
Carbon Tetrachloride	4E-6	5E-1
Chlorobenzene	--	2E+0
Chloroform	2E-5	3E+0
Chromium (VI)	--	2E+0
Copper	--	2E-1
Cyanide	--	3E-1
Mercury	--	3E+1
Nickel	--	3E+0
Pentachlorobenzene	--	6E-1
Pentachloronitrobenzene	7E-6	1E-1
Inhalation of OU-1 Groundwater Volatile Compounds		
Cumulative Risk for Pathway	--	1E+1
Chlorobenzene	--	8E-1
Mercury	--	1E+1
Dermal Contact with OU-1 Groundwater		
Cumulative Risk for Pathway	--	1E+0
1,2,4-trichlorobenzene	--	2E-1
1,2-dichlorobenzene	--	1E-1
Chlorobenzene	--	1E-1
Chloroform	--	7E-1

NOTE: [1] Remedial goal options were not developed for the current receptors (i.e., off-site resident/trespassers or industrial workers) because none of the pathways for these receptors exceeded the 1 x 10^{-4} excess lifetime cancer risk or a 1.0 hazard index.

-- Remedial goal options were not developed for this pathway/chemical either because the pathway contributed less than 1 x 10^{-4} excess lifetime cancer risk and less than 1.0 hazard index, or the chemical contributed less than 1 x 10^{-6} excess lifetime cancer risk and less than a 0.1 hazard quotient.

The risk assessment indicates that only risks associated with potential future on-site resident exposures to contaminated groundwater and surface soils would not be within EPA's acceptable risk range. The chemicals of concern would pose unacceptable risks if the on-site groundwater were used as a source of potable water or if children living on the site were exposed to contaminated surface soils. Future use of this site as a residential area is considered unlikely and thus the proposed remedial goals are directed at protecting the groundwater for its maximum beneficial use.

6.5 CLEANUP LEVELS

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an eminent and substantial endangerment to public health, welfare, or the environment.

Fate and transport analysis provided an evaluation of the potential effects on groundwater from the SWMUs/AOCs. The analysis was conducted by assuming that the source concentration was the maximum concentration detected in the soils. In cases where site-specific leachate test (TCLP) data were available, the maximum concentration from the TCLP extract was assumed to be the leachate concentration at the source. Cleanup levels were developed (see tables below) for the groundwater, the old plant landfill drainage ditch, the old CPC plant landfill, and for the area west of the former CPC plant. These cleanup levels for groundwater are based on MCLs or health-based calculations. Cleanup levels for the area west of the former CPC plant are based on protection of groundwater for domestic use from contaminants which may migrate from the soils to the groundwater.

The tables on the following page include cleanup levels for groundwater based on SDWA MCLs or health-based calculations and cleanup levels for subsurface soil were based on protection of groundwater for domestic use from leachable chemicals. Cleanup levels for soils were developed for the protection of groundwater at the groundwater cleanup level.

CLEANUP PERFORMANCE STANDARDS FOR GROUNDWATER

Constituent	Cleanup Goal(µg/l)
Alpha-BHC	0.013
Benzene	5
Chlorobenzene	100
1,2,4-Trichlorobenzene	70
1,2-Dichlorobenzene	600
1,3-Dichlorobenzene	75
1,4-Dichlorobenzene	75
Mercury	2
Pentachlorobenzene	29
Pentachloronitrobenzene	0.29

CLEANUP PERFORMANCE STANDARDS FOR SOILS[1,2]

Constituent	Soil Cleanup Goal (mg/kg)
Benzene	5
Chlorobenzene	79
1,2-Dichlorobenzene	1,645
1,3-Dichlorobenzene	140
1,4-Dichlorobenzene	140
1,2,4-Trichlorobenzene	1,000
Mercury	55

[1] Cleanup levels will be developed for Alpha-BHC, Pentachlorobenzene, Pentachloronitrobenzene if they are encountered during the cleanup.

[2] Cleanup levels for soils were developed for the protection of groundwater at the groundwater cleanup level.

7.0 DESCRIPTION OF ALTERNATIVES

The Feasibility Study Report evaluated possible alternatives for remediation of conditions at the Olin site. Several alternatives were retained for the detailed analysis consideration. In OU-1 there are four (4) general areas which have been evaluated for remediation. Those areas are:

1 - Groundwater
2 - Old Plant (CPC) Landfill (includes Old Plant Landfill Drainage Ditch)
3 - Area West of the Former CPC Plant
4 - (Collectively) The Sanitary Landfills, Lime Ponds, Strong Brine Pond, Mercury Cell Plant and the Well Sand Residue Area.

THE FOLLOWING IS A SUMMARY OF ALTERNATIVES EVALUATED IN THE FS:

7.1 GROUNDWATER

Alternative A - No Action With Continuation of Existing RCRA Corrective Action Program (CAP) which prevents and controls off-site contamination/ contingency to provide municipal water.

Alternative C1 - Pump and Treat System (Additional Vertical Extraction Wells)/Discharge

Alternative C3 - Extraction (Additional Vertical and Horizontal Wells)/Treatment/Discharge

7.2 Old Plant (CPC) Landfill

Alternative A (all source areas) - No Action

Alternative C - Containment (Improve Capping with additional Groundwater Monitoring)

Alternative D - In Situ (in place) Solidification-Stabilization/Containment (Capping), and additional Groundwater Monitoring

Alternative E - Excavation/Stabilization-Solidification, Containment (Capping), and additional Groundwater Monitoring

Alternative F - Excavation/Off-Site RCRA Disposal of fill/waste material with In Situ Stabilization of the underlying soils

Alternative G1 - Excavation/On-Site Thermal (heat) Treatment/Disposal of fill/waste material with In Situ Stabilization of the underlying soils and placement of treated materials into the landfill area.

7.3 Area West of Former CPC Plant

Alternative C - Containment which will include extension of the cap which exist in the area of the CPC plant, monitoring, and maintenance.

Alternative D - In Situ Stabilization-Solidification/Containment which will include construction of a protective cover (cap), monitoring and maintenance.

Alternative E - Excavation/Stabilization-Solidification/Containment which will include construction of a protective cover, monitoring and maintenance.

Alternative F - Excavation/Off-Site RCRA Disposal of contaminated soils. Installation of a protective cover (cap) over the excavated area.

Alternative G - Excavation/On-Site Thermal Treatment/Disposal with placement of the treated material into the excavated area and installation of a protective cover (cap).

7.4 Sanitary Landfills, Lime Ponds, Strong Brine Pond, Mercury CELL Plant and Well Sand Residue Area

Alternative B1 - Containment area Inspection/ maintenance, additional groundwater monitoring in areas not encompassed by the RCRA compliance monitoring, e.g., the sanitary landfill areas.

Alternative B2 - Containment area Inspection/ Maintenance, expanded groundwater and surface water monitoring in all areas.

Alternative C1 - Containment area Inspection/ Maintenance with installation of additional protective cover over and additional groundwater monitoring of the Sanitary Landfills. Additional cover over the Lime Ponds and Strong Brine Pond.

Alternative C2- Containment/Consolidation/ Inspection (Sanitary Landfills/Lime Ponds/Strong Brine Pond/Well Sand Residue Area) - Additional groundwater monitoring

8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA, 42 U.S.C. Section 9621, and in the NCP, 40 C.F.R, Section 300.430. The major objective of the FS was to develop, screen and evaluate alternatives for the remediation of the Olin Site. A wide variety of alternatives and technologies were identified as candidates to remediate the contamination at the Olin Site. These were screened based on their feasibility with respect to the contaminants present and the site characteristics. After the initial screening, the remaining alternatives/technologies were combined into potential remedial alternatives and evaluated in detail. The remedial alternative was selected from the screening process using the following nine evaluation criteria:

- Overall protection of human health and the environment;
- Compliance with applicable and/or relevant Federal or State public health or environmental standards;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility or volume of hazardous substances or contaminants;
- Short-term effectiveness or the impacts a remedy might have on the community, workers or the environment during the course of implementation;

- Implementability, that is, the administrative or technical capacity to carry out the alternative;
- Cost-effectiveness considering costs for construction, operation, and maintenance of the alternative over the life of the project, including additional costs should it fail;
- Acceptance by the State and
- Acceptance by the Community.

The NCP categorizes the nine criteria into three groups:

(1) **Threshold Criteria** - overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

(2) **Primary Balancing Criteria** - long-term effectiveness and permanence; reduction of toxicity, mobility or volume; short-term effectiveness; implementability and cost are primary balancing factors used to weigh major trade-offs among alternative hazardous waste management strategies; and

(3) **Modifying Criteria** - state and community acceptance are modifying criteria that are formally taken into account after public comments are received on the proposed plan and incorporated in the ROD.

The selected alternative must meet the threshold criteria and comply with all ARARs or be granted a waiver for compliance with ARARs. Any alternative that does not satisfy both of these requirements is not eligible for selection. The Primary Balancing Criteria is the technical criteria upon which the detailed analysis of alternatives is primarily based. The final two criteria, known as Modifying Criteria, assess the public's and the state agency's acceptance of the alternative. Based on these final two criteria, EPA may modify aspects of a specific alternative.

The potential action specific, chemical specific and State ARARs are presented in the following tables.

A = APPLICABLE REQUIREMENTS WHICH WERE PROMULGATED UNDER FEDERAL LAW TO SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION LOCATION OR OTHER CIRCUMSTANCE AT THE OLIN SITE.

R & A = RELEVANT AND APPROPRIATE REQUIREMENTS WHICH WHILE THEY ARE NOT "APPLICABLE" TO A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION, OR OTHER CIRCUMSTANCE AT THE OLIN SITE, ADDRESS PROBLEMS OR SITUATIONS SUFFICIENTLY SIMILAR TO THOSE ENCOUNTERED AT THE OLIN SITE THAT THEIR USE IS WELL SUITED TO THE SITE.

ACTION-SPECIFIC FEDERAL ARARS FOR THE OLIN SITE		
CLEAN WATER ACT - 33 U. S. C. 1251-1376		
A	40 CFR Part 122, 125 - National Pollutant Discharge Elimination System	Requires permits for the discharge of pollutants for any point source into waters of the United States.
R & A	40 CFR Part 403 - National Pretreatment Standards	Sets standards to control pollutants which pass through or interfere with treatment processes in public treatment works or which may contaminate sewage sludge.
RESOURCE CONSERVATION AND RECOVERY ACT - 42 U.S.C. 6901-6987		
A	40 CFR Part 257 - Criteria for Classification of Solid Waste Disposal Facilities and Practices	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on public health or the environment.
A	40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste	Establishes standards for generators of hazardous wastes.
R & A	40 CFR Part 263 - Standards Applicable to Transportation of Hazardous Waste	Establishes standards which apply to transporters of hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR PaRt 262.
A	40 CFR Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal (TSD) Facilities	Establishes minimum national standards which define the acceptable management of hazardous wastes for owners and operators of facilities which treat, store or dispose of hazardous wastes.
A	40 CFR Part 268 - Land Disposal	Identifies hazardous wastes that are restricted from land disposal and describes those circumstances under which an otherwise prohibited waste may be land disposed.
SAFE DRINKING WATER ACT		
A	40 CFR Parts 144 - 147 - Underground Injection Control Regulations	Provides for protection of underground sources of drinking water
HAZARDOUS MATERIALS TRANSPORTATION ACT - 49 U.S. C 1801-1813		
R & A	40 CFR Parts 107, 171-177 - Hazardous Materials Transportation Regulations	Regulates transportation of hazardous materials.

CHEMICAL-SPECIFIC FEDERAL ARARS FOR THE OLIN SITE		
CLEAN WATER ACT - 33 U. S. C. 1251-1376		
A	40 CFR Part 131 - Ambient Water Quality Criteria requirements	Suggested ambient standards for the protection of human health and aquatic life.
R & A	40 CFR Part 403 - National Pretreatment Standards	Sets standards to control pollutants which pass through or interfere with treatment processes in publicly-owned treatment works or which may contaminate sewage sludge.
RESOURCE CONSERVATION AND RECOVERY ACT - 42 U.S.C. 6901-6987		
A	40 CFR Part 261 - Identification and Listing of Hazardous Wastes	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 263-265 and Parts 124, 270, and 271.
A	40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste	Establishes standards for generators of hazardous waste.
CLEAN AIR ACT - 42 USC Section 7401 - 7642		
A	40 CFR Part 50 - National Primary and Secondary Ambient Air Quality Standards	Establishes standards for ambient air quality to protect public health and welfare.
SAFE DRINKING WATER ACT - 40 USC Section 300		
A	40 CFR Part 141 - National Primary Drinking Water Standards	Establishes maximum contaminant levels (MCLs) which are health-based standards for public water systems.

CHEMICAL-SPECIFIC FEDERAL ARARS FOR THE OLIN SITE		
A	PL No. 99-339 100 Stat.462 (1986) - Maximum Contaminant Level Goals (MCLGs)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects with an adequate margin of safety.

STATE OF ALABAMA ARARS FOR THE OLIN SITE

REGULATION	APPLICABLE OR RELEVANT AND APPROPRIATE	BASIS FOR DETERMINATION
Alabama Water Pollution Control Act code of Alabama, Title 22, Chapter 22 - Water Improvement Commission)	Applicable requirement which was promulgated by the state of alabama to specifically address a hazardous substance, pollutant, contaminant, remedial action location or other circumstance at the site.	Establishes standards for limits of pollution and quality of water.
Alabama National Pollutant Discharge Elimination System Permit Regulations (Alabama Administrative Codc, Department of Environmental Management, Water Division, Water Quality Program, Chapter 335-6-6 NPDES; adopted October 19, 1979; amended January 24, 1989)	Applicable requirement which was promulgated by the state of alabama to specifically address a hazardous substance, pollutant, contaminant, remedial action location or other circumstance at the site.	State administered permit program comparable to the national permitting system.
Alabama primary drinking water standards (alabama administrative code, department of environmental management, water division - water supply program, chapter 335-7-2-primary drinking water standards; adopted january 4, 1989)	Applicable requirement which was promulgated by the state of alabama to specifically address a hazardous substance, pollutant, contaminant, remedial action location or other circumstance at the site.	Applicable to water systems required to monitor for various contaminants.
Maximum Concentration of Constituents for Groundwater Protection (Alabama Administrative Code, Department of Environmental Management, Hazardous Waste Program, Chapter 335-14-5.06-Releases from Solid Waste Management Units; adopted June 8,m 1983; amended January 25, 1992)	Applicable requirement which was promulgated by the state of alabama to specifically address a hazardous substance, pollutant, contaminant, remedial action location or other circumstance at the site.	Applies to owners/operators of facilities that transport, store, or dispose of hazardous waste.

The following tables represent an analysis of the evaluation of alternatives for remediating the Olin Site under each of the criteria. A comparison is made between each of the alternatives for achievement of a specific criterion.

TABLE 8-4
SUMMARY OF DETAILED ANALYSIS
OU-1 GROUNDWATER

Alternative	Overall Protection of Human Health and Environment	Compliance With ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Short-Term Effectiveness	Implementability	Present Worth Cost Estimate ($1,000)
Alternative A: No Action with Continuation of the Existing RCRA CAP	May not be protective. Although Olin is committed by RCRA post-closure permit to operate the CAP until the established clean-up standards are achieved the CAP does not address all areas of contamination at the Site. Specifically the area of dense brine accumulation and possible offsite contamination.	May not comply: RCRA permit levels, MCLs and MCLGs are chemical-specific ARARS. May comply with action-specific ARARs. However, the existing RCRA permit can not address the HSWA requirements under Federal law and regulations.	Effectiveness and permanence dependent on ability of the RCRA permit to address all areas of contamination at the site.	Reduces toxicity, mobility and volume of some contaminants but will not address the area of dense brine accumulation.	No short-term adverse effects.	Already Implemented	None
Alternative C1: Extraction/ Treatment/ Discharge (Vertical Extraction Wells)	Protective: Adds to protectiveness of existing CAP with accelerated contaminant removal. Would control off-site migration.	Would Comply: Would reduce time period for compliance with chemical-specific ARARs. System would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 groundwater.	Effective over long term. Permanence dependent on effectiveness at remediating potential source areas.	Reduces toxicity, mobility and volume in the aquifer. Contaminants would be transferred to air and carbon. Disposal of carbon reduces mobility.	Minimal short term adverse effects from potential worker exposure during well installation. Human health risks from exposure during sampling/operation and volatile emissions are considered negligible.	Vertical extraction wells are readily implementable as demonstrated by the existing CAP. Treatability testing may be required to design TDS treatment.	$3,9'
Alternative C3: Extraction/ Treatment/ Discharge (Vertical and Horizontal Extraction Wells)	Protective: Adds to protectiveness of existing CAP with accelerated contaminant removal. Would control off-site migration.	Would Comply: Would reduce time period for compliance with chemical-specific ARARs. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 groundwater.	Effective over long term. Permanence dependent of effectiveness at remediating potential source areas.	Reduces toxicity, mobility and volume in aquifer. Contaminants would be transferred to air and carbon. Disposal of carbon reduces mobility.	Minimal short term adverse effects from potential worker exposure during well installation. Human health risks from exposure during sampling/operation and volatile emissions are considered negligible.	Vertical extraction well would be readily implementable. Horizontal extraction wells are implementable but require specialized equipment and contractors. Treatability testing may be required to design TDS treatment.	$4,570

TABLE 8-5
SUMMARY OF DETAILED ANALYSIS OU-1 SOIL
OLD PLANT (CPC) LANDFILL

Alternative	Overall Protection of Human Health and Environment	Compliance With ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Short-Term Effectiveness	Implementability	Present Worth Cost Estimate ($1,000)
Alternative C: Containment (Improved Capping)	Protective: Most areas beneath the landfill showed concentrations that were below the recommended preliminary soil action levels (PSALs), indicating only localized areas may be a continuing source. Would reduce infiltration to groundwater.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Permanence would depend on cap maintenance.	Mobility to groundwater would be reduced with reduced infiltration. No reduction in toxicity or volume.	There would be little to no adverse short-term effects. The existing clay cover would not be removed completely to prevent worker exposure.	Readily implementable: The technology is well demonstrated and could be implemented with standard construction equipment and practices.	$2,164
Alternative D: In Situ Stabilization-Solidification/ Containment	Protective: Most areas beneath the landfill showed concentrations that were below the recommended preliminary soil action levels (PSALs), indicating only localized areas may be a continuing source. Would reduce further degradation of the Alluvial Aquifer.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soi[illegible]	Would result in reduction in rate of infiltration to the groundwater. Contaminants would be permanently immobilized.	Reduction in mobility by reduced infiltration and stabilization/solidification of residual contamination. Volume increase would occur due to addition of reagent. No significan[illegible] reduction in toxicity Satisfies the statutory preference of using treatment as a principal component.	Potential adverse short-term adverse effects to workers from intrusive activity and dust generation. Short-term adverse effects are not expected for area resi[illegible]ents.	Based on existing information, could be implemented with moderate-to-high difficulty. Obstructions may hinder productivity and implementability. Bench-scale testing and additional characterization required.	$16,155
Alternative E: Excavation/ Stabilization-Solidification/ Containment	Protective: Most areas beneath the landfill showed concentrations that were below the recommended preliminary soil action levels (PSALs), indicating only localized areas may be a continuing source. Would reduce further degradation of the Alluvial Aquifer.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Contaminants would be permanently immobilized.	Reduction in mobility by reduced infiltration and stabilization/solidification of residual contamination. Volume increase would occur due to addition of reagent. No significant reduction in toxicity Satisfies the statutory preference of using treatment as a principal component.	Potential short-term adverse effects to workers from exposure during excavation and handling of material and dust generation during in situ S/S. Minimal potential off-site adverse effects with proper excavation and engineering controls.	Moderately difficult to implement. Excavation difficulties may occur due to debris in landfill and proximity of surrounding structures. Bench-scale testing and additional characterization required.	$30,089

TABLE 8-5 (Continued)
SUMMARY OF DETAILED ANALYSIS OU-1 SOILS
OLD PLANT (CPC) LANDFILL

Alternative	Overall Protection of Human Health and Environment	Compliance With ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Short-Term Effectiveness	Implementability	Present Worth Cost Estimate ($1,000)
Alternative F: Excavation/ Off-Site RCRA Disposal	Protective: Most areas beneath the landfill showed concentrations that were below the recommended preliminary soil action levels (PSALs), indicating only localized areas may be a continuing source. Would reduce further degradation of the Alluvial Aquifer.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Contaminants in upper 15 feet would be removed from the site. Permanent immobilization of contamination in residual material (15 to 30 feet)	Volume of waste on-site would be reduced. Reduction in mobility by reduced infiltration and stabilization/solidification of residual contamination from 15 to 30 feet. No reduction in toxicity of material.	Potential short-term adverse effects to workers from exposure during excavation and handling of material and dust generation during in situ S/S. Minimal potential off-site adverse effects with proper excavation and engineering controls. Potential for short-term risks to public from spills during off-site transportation.	Moderately difficult to implement due to excavation and in situ stabilization/solidification. Excavation difficulties may occur due to debris in landfill and proximity of surrounding structures. Bench-scale testing for in situ stabilization/ solidification and additional characterization required.	$73,347
Alternative G1: Excavation/ On-Site Thermal Treatment/ Disposal	Protective: Most areas beneath the landfill showed concentrations that were below the recommended preliminary soil action levels (PSALs), indicating only localized areas may be a continuing source. Would reduce further degradation of the Alluvial Aquifer.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Contaminants in upper 15 feet would be permanently destroyed. Permanent immobilization of contamination in residual material (15 to 30 feet).	Reduction in toxicity/mobility and volume of contaminated material in upper 15 feet with thermal treatment. Reduction in mobility of residual contamination Satisfies the statutory preference of using treatment as a principal component.	Potential short-term adverse effects to workers from exposure during excavation and handling of material and dust generation during in situ S/S. Minimal potential off-site adverse effects with proper excavation and engineering controls. Potential risk to workers during operation of incinerator due to high operating temperatures and complexity of equipment. Potential air emissions could temporarily affect air quality.	Difficult to implement. Bench-scale testing and additional characterization required. Excavation difficulties may occur due to debris in landfill and proximity of surrounding structures. Incinerator is complex technology, requires highly-skilled personnel. A long lead time may be required due to incinerator availability.	$108,908

TABLE 8-6
SUMMARY OF DETAILED ANALYSIS OU-1 SOIL
AREA WEST OF FORMER CPC PLANT

Alternative	Overall Protection of Human Health and Environment	Compliance With ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Short-Term Effectiveness	Implementability	Present Worth Cost Estimate ($1,000)
Alternative C: Containment (Extend Existing Cap)	Protective: Soil concentrations were below the recommended preliminary soil action levels (PSALs), indicating a low potential for the soils to be a continuing source. Would reduce infiltration to groundwater.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Permanence would depend on cap maintenance.	Mobility to groundwater would be reduced with reduced infiltration. No reduction in toxicity or volume.	There would be little to no adverse short-term effects.	Readily implementable: The technology is well demonstrated and could be implemented with standard construction equipment and practices.	$379
Alternative D: In Situ Stabilization-Solidification/Containment	Protective: Soil concentrations were below the recommended preliminary soil action levels (PSALs), indicating a low potential for the soils to be a continuing source. Would reduce further degradation of the Alluvial Aquifer.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Contaminants would be permanently immobilized.	Reduction in mobility by reduced infiltration and stabilization/solidification of residual contamination. Volume increase would occur due to addition of reagent. No significant reduction in toxicity Satisfies the statuary preference for treatment.	Potential adverse short-term adverse effects to workers from intrusive activity and dust generation. Short-term adverse effects are not expected for area residents.	Based on existing information, could be implemented with moderate difficulty. Bench-scale testing and additional characterization required.	$1,307
Alternative E: Excavation/Stabilization-Solidification/Containment	Protective: Soil concentrations were below the recommended preliminary soil action levels (PSALs), indicating a low potential for the soils to be a continuing source. Would reduce further degradation of the Alluvial Aquifer.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Contaminants would be permanently immobilized.	Reduction in mobility by reduced infiltration and stabilization/solidification of residual contamination. Volume increase would occur due to addition of reagent. No significant reduction in toxicity Satisfies the statuary preference for treatment.	Potential short-term adverse effects to workers from exposure during excavation and handling of material and dust generation during in situ S/S. Minimal potential off-site adverse effects with proper excavation and engineering controls.	Moderately difficult to implement. Excavation may be difficult because the work would be in a relative confined area. Bench-scale testing required.	$2,348

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TABLE 8-6(Continued)
SUMMARY OF DETAILED ANALYSIS OU-1 SOILS
AREA WEST OF FORMER CPC PLANT

Alternative	Overall Protection of Human Health and Environment	Compliance With ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Short-Term Effectiveness	Implementability	Present Worth Cost Estimate ($1,000)
Alternative F: Excavation/ Off-Site RCRA Disposal	Protective: Soil concentrations were below the recommended preliminary soil action levels (PSALs), indicating a low potential for the soils to be a continuing source. Would reduce further degradation of the Alluvial Aquifer.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Contaminants in upper would be removed from the site.	Volume of contaminated soil on-site would be reduced. Contaminated soil would be disposed of in an off-site landfill where mobility would be reduced. No reduction in toxicity.	Potential short-term adverse effects to workers from exposure during excavation and handling of material. Potential for short-term risks to public from spills during off-site transportation.	Moderately difficult to implement. Excavation may be difficult because the work would be in a relative confined area.	$7,560
Alternative G1: Excavation/ On-Site Thermal Treatment/ Disposal	Protective: Soil concentrations were below the recommended preliminary soil action levels (PSALs), indicating a low potential for the soils to be a continuing source. Would reduce further degradation of the Alluvial Aquifer.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would result in reduction in rate of infiltration to the groundwater. Contaminants would be permanently destroyed.	Reduction in toxicity/mobility and volume of contaminated material. Satisfies the statuary preference for treatment.	Potential short-term adverse effects to workers from exposure during excavation and handling of material. Potential risk to workers during operation of incinerator due to high operating temperatures and complexity of equipment. Potential air emissions could temporarily affect air quality.	Difficult to implement. Bench-scale testing required. Excavation may be difficult because the work would be in a relative confined area. Incinerator is complex technology, requires highly-skilled personnel. A long lead time may be required due to incinerator availability.	$14,177

TABLE 8-7
SUMMARY OF DETAILED ANALYSIS OU-1 SOIL SANITARY LANDFILLS, LIME PONDS, STRONG BRINE POND, MERCURY CELL PLANT AND WELL SAND RESIDUE AREA

Alternative	Overall Protection of Human Health and Environment	Compliance With ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Short-Term Effectiveness	Implementability	Present Worth Cost Estimate ($1,000)
Alternative A: No Action	Protective: The fate transport analysis shows that the four SWMUs/AOCs are not current sources of groundwater contamination. Risk calculations indicate that the soils do not pose unacceptable risks from ingestion, direct contact and inhalation hazards. Surface water runoff from these SWMUs/ AOCs would be detected with the existing NPDES and stormwater monitoring programs.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Olin currently complies with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would provide long-term effectiveness and permanence because no unacceptable risks to human health and the environment were identified. Institutional actions (e.g., caps and monitoring) will indicate if conditions remain protective.	No reduction in toxicity or mobility.	No short term adverse effects.	Implementation is not required.	None
Alternative B1: Institutional Actions (Cap Inspection/ Maintenance, Groundwater Monitoring near Sanitary Landfills)	Protective: Would provide added protection (over no action) by ensuring continued maintenance of the caps. Groundwater monitoring would be extended to the sanitary landfill area where currently there is not routine monitoring.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would provide some added long-term effectiveness (over no action) by ensuring that risk do not increase. The alternative is considered permanent even though it includes long-term maintenance and monitoring programs because no unacceptable risks to human health and the environment were identified with the no action alternative.	No reduction in toxicity, mobility, or volume. The cap maintenance programs would ensure that the mobility of constituents would not increase.	There would be little to no short-term adverse effects	Could be easily implemented.	$3,226

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SUMMARY OF DETAILED ANALYSIS OU-1 SOILS
SANITARY LANDFILLS, LIME PONDS, STRONG BRINE POND
MERCURY CELL PLANT AND WELL SAND RESIDUE AREA (Continued)

Alternative	Overall Protection of Human Health and Environment	Compliance With ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Short-Term Effectiveness	Implementability	Present Worth Cost Estimate ($1,000)
Alternative B2: Institutional Actions (Cap Inspection/ Maintenance, Expanded Groundwater and Surface Water Monitoring)	Protective: Would provide added protection (over no action) by ensuring continued maintenance of the caps. Groundwater monitoring would be extended to the sanitary landfill area where currently there is not routine monitoring.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would provide some added long-term effectiveness (over no action) by ensuring that risk do not increase. The alternative is considered permanent even though it includes long-term maintenance and monitoring programs because no unacceptable risks to human health and the environment were identified with the no action alternative. Groundwater and additional surface water monitoring in the vicinity of the lime ponds, strong brine pond and the mercury cell plant would have limited effectiveness.	No reduction in toxicity, mobility, or volume. The cap maintenance programs would ensure that the mobility of constituents would not increase.	There would be little to no short-term adverse effects	Could be easily implemented.	$4,360
Alternative C1: Containment (Sanitary Landfills, Lime Ponds and Strong Brine Pond)/ Institutional Actions	Protective: Would provide added protection (over no action) with more competent physical barriers over the sanitary landfill soils, lime ponds and the strong brine pond. Would provide added protection (over no action) by ensuring continued maintenance of the caps. Groundwater monitoring would be extended to the sanitary landfill area where currently there is not routine monitoring.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would provide some added long-term effectiveness (over no action) with construction of the caps and the monitoring/ maintenance programs by ensuring that conditions do not change	Mobility would be reduced due to the improved caps. There would be no reductio[illegible] 1 toxicity or volume [illegible] contamination.	There would be li[illegible]le to no short-term adverse effects	Readily implementable.	$8,079

SUMMARY OF DETAILED ANALYSIS OU-1 SOILS
SANITARY LANDFILLS, LIME PONDS, STRONG BRINE POND
MERCURY CELL PLANT AND WELL SAND RESIDUE AREA (Continued)

Alternative	Overall Protection of Human Health and Environment	Compliance With ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility and Volume	Short-Term Effectiveness	Implementability	Present Worth Cost Estimate ($1,000)
Alternative C2: Consolidation/ Containment (Sanitary Landfills, Lime Ponds, Strong Brine Pond and Well Sand Residue Area)/Institutional Actions	Protective: Would provide added protection (over no action) with more competent physical barriers over the sanitary landfill soils, lime ponds and the strong brine pond, and containment of the well sand residue. Would provide added protection (over no action) by ensuring continued maintenance of the caps. Groundwater monitoring would be extended to the sanitary landfill area where currently there is not routine monitoring.	Would Comply: Implemented in conjunction with the RCRA CAP would comply with chemical-specific ARARs for Groundwater. Would be implemented to comply with action-specific ARARs. There are no known location-specific ARARS for OU-1 soils.	Would provide some added long-term effectiveness (over no action) with construction of the caps and the monitoring/ maintenance programs by ensuring that conditions do not change. Containment of the well sand would provide marginal, if any, added effectiveness because it is a cemented material with mercury bound in the matrix.	Mobility would be reduced due to th nproved caps. There would be no reduction in toxicity or volume of contamination.	There would be little to no short-term adverse effects	Readily implementable.	$8,352

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8.1 STATE ACCEPTANCE

The State of Alabama has concurred with the selected remedy.

8.2 COMMUNITY ACCEPTANCE

Based upon comments received, the reaction of the community has been generally favorable.

9.0 SUMMARY OF SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected a source control and groundwater remedy for OU #1 of the Site. The remedy consist of the following:

Old Plant (CPC) Landfill - **Alternative C** - Containment (Improve Capping with additional Groundwater Monitoring)

Area West of Former CPC Plant - **Alternative C** - Containment which will include extension of the cap which exist in the area of the CPC plant, monitoring, and maintenance.

Sanitary Landfills, Lime Ponds, Strong Brine Pond, Mercury CELL Plant, and Well Sand Residue Area - **Alternative B1** - Containment area Inspection/ maintenance, additional groundwater monitoring in areas not encompassed by the RCRA compliance monitoring, e.g., the sanitary landfill areas.

GROUNDWATER - **Alternative C3** - Extraction (Additional Vertical and Horizontal Wells)/Treatment/Discharge

The selected remedy provides for the following:

1. Extracting contaminated groundwater from horizontal and vertical wells and treatment of the extracted groundwater;

2. Upgrading the existing cap over the old plant (CPC) landfill with a multimedia cap and performing additional groundwater monitoring in the vicinity of the landfill. The CPC landfill cap will be extended to encompass the former drainage ditch area;

3. Extending the clay cap that exists over the former CPC plant to the west, capping the contaminated soils;

4. Additional groundwater monitoring in the vicinity of the sanitary landfills. In the event that monitoring indicates releases from this area, additional corrective action measures will be required;

5. Quarterly monitoring and maintenance of the existing clay caps over the sanitary landfills, the lime ponds, and the strong brine pond, the asphalt cover over the mercury cell plant, and the fencing around the well sand residue area. The findings of the

inspections will be documented. If an inspection noted problem areas such as erosional areas, cracks in the asphalt, or insufficient cap depth, maintenance or corrective measures will be required. Maintenance and corrective measures will also be documented;

6 Monitoring to determine the effectiveness of the groundwater treatment in reducing the contaminant migration; and

7. Institutional controls for land use and groundwater use restrictions.

The estimated present worth cost of the selected remedy is $10,339,000. The estimates were based on a variety of information, including estimates from vendors, generic unit costs, and conventional cost estimating guides. Capital and operation and maintenance costs were estimated for each alternative and were used to calculate present net worth. The estimated present worth costs for the major components of each alternative are summarized in Section 5 of the Feasibility Study.

A. GROUNDWATER REMEDIATION

Groundwater remediation with extraction of contaminated groundwater from horizontal and vertical wells.

A.1. The major components of groundwater remediation to be implemented include:

- Extraction and onsite treatment of groundwater;
- Institutional controls, such as deed and land-use restrictions.

A.2. Extraction, Treatment, and Discharge of Contaminated Groundwater

Installation of horizontal and vertical wells for extraction of contaminated groundwater. The horizontal extraction wells would be designed to capture the area of dense brine accumulation. The vertical extraction wells will be designed to accelerate removal of organics from the area of the old plant (CPC) landfill. Additional monitor wells will be installed in the vicinity of the old plant (CPC) landfill to monitor the effectiveness of the system.

A.3. Performance Standards

a. Treatment Standards

Groundwater shall be treated until the following maximum concentration levels are attained at the wells designated by EPA as compliance points.

CLEANUP PERFORMANCE STANDARDS FOR GROUNDWATER

Constituent	Cleanup Goal(μg/l)
Alpha-BHC	0.013
Benzene	5
Chlorobenzene	100
1,2,4-Trichlorobenzene	70
1,2-Dichlorobenzene	600
1,3-Dichlorobenzene	75
1,4-Dichlorobenzene	75
Mercury	2
Pentachlorobenzene	29
Pentachloronitrobenzene	0.29

It may become apparent during the implementation or operation of the treatment system that contaminant levels have ceased to decline and are remaining constant at levels higher than the treatment standards. In such a case, the system's performance may be reevaluated by EPA, in consultation with ADEM.

b. Discharge Standards

Discharges from the groundwater treatment system shall comply with all ARARs, including, but not limited to requirements of the NPDES permitting program under the Clean Water Act, 33 U.S.C. { 1251 et seq., and all effluent limits established by EPA.

c. Design Standards

The design, construction and operation of the groundwater treatment system shall be conducted in accordance with all ARARs, including but not limited to the RCRA requirements set forth in 40 C.F.R. Part 264 (Subpart F).]

B. Compliance Monitoring

Groundwater monitoring shall be conducted at this site. After demonstration of compliance with Performance Standards, the Site groundwater shall be monitored for five years. If monitoring indicates that the Performance Standards set forth in Paragraph A.3(a) are being exceeded at any time after pumping has been discontinued, extraction and treatment of the groundwater will recommence until the Performance Standards are once again achieved.

Air emissions during the cleanup will be monitored to ensure safety of workers and residents near the Site.

Air emissions from the Site will be monitored to ensure compliance with the Clean Air Act. Air monitoring will be conducted to ensure that contaminant concentrations do not exceed levels considered to be safe for human health. If levels are exceeded, mitigative procedures such as dust suppression or vapor capture will be employed to prevent harmful levels of air emissions from leaving the Site.

'. Source Control

Source control remediation will address active remediation of the Old Plant (CPC) Landfill (including the drainage ditch), and the Area West of the Former CPC Plant. It also includes additional groundwater monitoring in the vicinity of the sanitary landfills and institutional actions for the other SWMUs, i.e., the sanitary landfills, the lime ponds, and the strong brine pond, the mercury cell plant, and the well sand residue area.

C.1. The major components of source control to be implemented include:

Upgrading and extending the existing cap over the old plant (CPC) landfill with a multimedia cap and performing additional groundwater monitoring in the vicinity of the landfill. The CPC landfill cap will be extended to encompass the former drainage ditch area. The clay cap that exists over the former CPC plant will be extended to the west, capping the contaminated soils; Quarterly monitoring and maintenance of the existing clay caps over the sanitary landfills, the lime ponds, and the strong brine pond, the asphalt cover over the mercury cell plant, and the fencing around the well sand residue area will be established. The findings of the inspections will be documented. If an inspection noted problem areas such as erosional areas, cracks in the asphalt, or insufficient cap depth, maintenance or corrective measures will be required. Maintenance and corrective measures will also be documented; additional groundwater monitoring in the vicinity of the sanitary landfills will be implemented. In the event that monitoring indicates releases from the sanitary landfills, additional corrective action measures will be required.

C.2. Performance Standards

The performance standards for this component of the selected remedy include, but are not limited to, the following excavation and treatment standards:
a.Standards for containment:

The caps over the Old Plant (CPC) Landfill (including the drainage ditch), and the Area West of the Former CPC Plant shall be designed to encompass all soils where the level of contamination exceeds the levels specified in the table below.

CLEANUP PERFORMANCE STANDARDS FOR SOILS[1,2]

Constituent	Soil Cleanup Goal (mg/kg)
Benzene	5
Chlorobenzene	79
1,2-Dichlorobenzene	1,645
1,3-Dichlorobenzene	140
1,4-Dichlorobenzene	140
1,2,4-Trichlorobenzene	1,000
Mercury	55

[1] Cleanup levels will be developed for Alpha-BHC, Pentachlorobenzene, Pentachloronitrobenzene if they are encountered during the cleanup.

[2] Cleanup levels for soils were developed for the protection of groundwater at the groundwater cleanup level.

The selected alternative for Operable Unit #1 of the Olin site is consistent with the requirements of Section 121 of CERCLA and the National Contingency Plan. The selected alternative will reduce the mobility, toxicity, and volume of contaminated groundwater at the Site. In addition, the selected alternative is protective of human health and the environment, will attain all Federal and State applicable or relevant and appropriate requirements, is cost-effective and utilizes permanent solutions to the maximum extent practicable.

Based on the information available at this time, the selected alternative represents the best balance among the criteria used to evaluate remedies.

The selected remedy will include groundwater extraction and monitoring, during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. Modifications may include any or all of the following:

- at individual wells where cleanup goals have been attained, pumping may be discontinued;
- alternating pumping at wells to eliminate stagnation points;
- pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater; and
- installation of additional extraction wells to facilitate or accelerate cleanup of the contaminant plume.

To ensure that cleanup goals continue to be maintained, the aquifer will be monitored at least annually for five years following discontinuation of groundwater extraction for those wells where pumping has ceased.

The decision to invoke any or all of these measures may be made during periodic review of the remedial action, which will occur at least every five years in accordance with CERCLA section 121 (c) and the NCP.

10.0 STATUTORY DETERMINATION

The selected remedy satisfies the requirement of CERCLA section 121 to protect human health and the environment by eliminating and by reducing risks posed through each pathway and population through treatment. The remedy ensures adequate protection of human health and the environment. The site risk will be reduced to the 10^{-6} risk range for carcinogens, and a Hazard Index for non-carcinogens of less than one.

No short-term risks or cross-media impacts will be caused by implementation of the remedy. The selected remedy satisfies the requirement of CERCLA section 121 to comply with ARARS.

The selected remedy provides overall effectiveness proportionate to its costs (i.e., is cost-effective). The selected remedy satisfies the requirement of CERCLA section 121 to utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The selected remedy provides the best balance of tradeoffs among the alternatives with respect to the evaluation criteria. Those criteria that were most critical in the selection decision (i.e., those criteria that distinguish the alternatives most) are: Overall protection of human health and the environment, compliance with ARARs; reduction of toxicity, mobility and volume through treatment; long term effectiveness and permanence; state and community acceptance.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There have been no significant changes from the proposed plan.

APPENDIX A:

RESPONSIVENESS SUMMARY - OLIN CHEMICALS SITE

1. Q. What contamination was found during the Domestic Well survey?

   A. No contamination was found at unsafe levels. Only two of the 34 wells which were sampled show any signs of contamination at all and in those two wells the levels that were found were well below the level which is considered safe.

2. Q. Why is there no proposal for groundwater monitoring in the neighborhood just south of River Road?

   A. The language in the proposed plan said, "Monitoring wells would be added to supplement Olin's RCRA quarterly monitoring program. Land-use restrictions would be applied as EPA determines appropriate." If the existing monitoring well network is not adequate to monitor the potential for contaminant migration toward off-site residences, additional wells will be installed.

3. Q. What about air monitoring? Is the air safe? Will the remedy make sure that the air is safe for nearby residents.

   A. The initial analysis of the potential for airborne contamination did not demonstrate that need. However, concerns raised at the public meeting have caused EPA to revisit the proposal. Further analysis of the adequacy of the existing air monitoring requirements will be examined. Additional air monitoring may be required in the cleanup design.

4. Q. How will covering the contamination with a cap help? Won't the contamination still be able to cause problems.

   A. If rainwater is allowed to move into the contaminated soils there is a potential for groundwater to be contaminated. Covering the areas of contamination will prevent the rainwater from moving into the contaminated soils.

5. Q. What about the increased cancer rate in the area. Is this due to the contamination?

   A. Representatives from the Alabama Department of Health have determined that there is not any indication of an unusual number of cancers in the area. They explained that because of the low population density, statistics may show an alarming increase in the number. That is, if the historical instance of cancers is 1 every 10 years and in one ten year period we see 2 cancers, the statistics will indicate a 100% increase in the cancer rate.

Q. EPA's groundwater cleanup level for alpha-BHC may be impractical to achieve due to the site's hydrogeology. If it is determined that certain portions of the aquifer cannot be restored to their maximum beneficial use, will there be any provison for reevaluation of the remedial technology employed or an adjustment of cleanup levels?

A. The language in Section 9 of the ROD states, "Groundwater shall be treated until the following maximum concentration levels are attained at the wells designated by EPA as compliance points. It may become apparent during the implementation or operation of the treatment system that contaminant levels have ceased to decline and are remaining constant at levels higher than the treatment standards. In such a case, the system's performance may be reevaluated by EPA, in consultation with ADEM."

APPENDIX B
CONCURRENCE LETTERS